REMARKS

Applicants respectfully request reconsideration and allowance of the pending claims.

I. Status of the Claims

Upon entry of this amendment, claims 30-34, 36-38, and 56-60 remain pending, while claims 40-51, 53-55, 61-62, and 68-74 have been canceled.

Support for the amendment to claim 30 may be found in paragraph [0010] of applicants' published application.

II. Double Patenting

The pending claims are provisionally rejected on the ground of non-statutory obviousness-type double patenting as being unpatentable over claims 1-27 of co-pending application Ser. No. 11/105,947. Unless and until the co-pending application matures into a patent, however, the appropriateness of such a rejection cannot be ascertained. Applicant will consider filing a terminal disclaimer to obviate this rejection when the application is otherwise in condition for allowance.

III. Claim Rejections Under 35 U.S.C. §103(a)

A. Method Claims

1. Claims 30-34, 36-38, and 56-60

Reconsideration is requested of the rejection of the method claims 30-34, 36-38, and 56-60 as being obvious over Dietterle et al. (WO02/24979 and U.S. 7,179,362) in view of Tsuji et al. (U.S. 6,607,653).

Claim 30 is directed to a method for electrolytic deposition of bronze onto a substrate. The method comprises:

> (i) immersing the substrate in an aqueous acidic electrolyte having a pH less than about 1 and comprising:
> a) tin ions;
> b) copper ions;
> c) an alkylsulfonic acid;
> d) an aromatic, nonionic wetting agent; and
> e) an oxidation inhibitor;
> wherein a ratio of tin ion concentration to copper ion concentration is sufficient to electrolytically deposit a bronze having a copper content of greater than about 60%; and
> (ii) applying a current **through a copper-tin anode and a cathode** at a current density sufficient to electrolytically deposit bronze having the copper content greater than about 60% onto the substrate.

One requirement of applicants' method is deposition employing a copper-tin anode. At the cathode (i.e., workpiece to be coated with bronze), a reduction reaction occurs whereby tin ions and copper ions are reduced to tin metal and copper metal as a bronze alloy. The reduction reactions at the cathode may be represented by the following equations (I) and (II):

$$Cu^{2+}_{(aq)} + 2e^-_{(cathode)} \Rightarrow Cu_{(s,\ cathode)} \quad (I)$$

$$Sn^{2+}_{(aq)} + 2e^-_{(cathode)} \Rightarrow Sn_{(s,\ cathode)} \quad (II)$$

The use of cathode in the subscripts in the above equations indicates that the cathode provides the electrons that reduce the copper ions and tin ions into the Cu metal and Sn metal onto the cathode workpiece.

The electrons that reduce copper ions and tin ions have a source, which is the anode. In general electrodeposition methods, the anode may be an inert anode

or a soluble anode. An inert anode, such as a platinum anode, oxidizes solution components to extract electrons to be used in the metal reduction at the cathode. Oxidation of solution components may cause waste products to build up, which is not always desirable. A soluble anode, on the other hand, such as the copper-tin anode required by claim 30, is itself oxidized. Applicants' copper-tin anode is oxidized according to the following equations (III) and (IV):

$$Cu_{(s,\ anode)} \Rightarrow Cu^{2+}_{(aq)} + 2e^-_{(anode)} \quad \text{(III)}$$

$$Sn_{(s,\ anode)} \Rightarrow Sn^{2+}_{(aq)} + 2e^-_{(anode)} \quad \text{(IV)}$$

The electrons in equations (III) and (IV) travel through the circuitry of the rectifier to the cathode workpiece. Thus, the electrons in equations (III) and (IV) are identical to the electrons in equations (I) and (II). Therefore, equations (I) - (IV) may be balanced to yield the overall reaction, represented by equations (V) and (VI):

$$Cu_{(s,\ anode)} \Rightarrow Cu_{(s,\ cathode)} \quad \text{(V)}$$

$$Sn_{(s,\ anode)} \Rightarrow Sn_{(s,\ cathode)} \quad \text{(VI)}$$

Essentially, therefore, applicants' method defined by claim 30 transfers copper and tin from the copper-tin anode to the cathode workpiece to yield a bronze coating thereon having the claimed at least about 60% by weight Cu. Initial concentrations of copper ions and tin ions are added to the electrolytic solution to provide metal ions to initiate the reaction and provide the ratio for copper and tin ions to yield the desired copper content in the bronze, while the copper-tin anode is used as a source of copper ions and tin ions throughout deposition.

The use of a copper-tin anode is advantageous for several reasons. First, by employing an anode comprising copper and tin, one need not, when plating a copper-tin alloy (i.e., a bronze) on a cathode workpiece, introduce all of the copper ions and tin ions into solution to adequately coat a workpiece with the bronze. The copper-tin anode itself may provide copper ions and tin ions in solution as deposition progresses. Related thereto, since the concentrations of copper ion and tin ion may be decreased, the concentrations of other solution components, such as complexing agents and stabilizers, may also be decreased since the need for organics to stabilize the solution is lessened. Second, since the anode itself is oxidized, organic components in the solution are not oxidized, thus decreasing the buildup of undesirable waste products. Third, the use of a copper-tin anode enhances control of the copper-to-tin ratio in the deposited bronze. As deposition progresses and copper ions and tin ions are depleted from solution, the copper-tin anode provides copper ions and tin ions to replenish the solution with metal ions, thereby maintaining the uniformity of the copper ion and tin ion concentrations in solution, which thereby enhances the uniformity of the bronze coating on the cathode. Accordingly, use of a copper-tin anode allows one to deposit, for example a 60% copper/40% tin bronze that will have that concentration of copper metal and tin metal throughout the beginning, middle, and the end of deposition, such that the initial deposit, the bulk of the layer, and the top layer all have substantially the same composition. Finally, since the copper-tin ratio may be carefully controlled through the use of the copper-tin

anode, deposition may occur at a wide variety of current densities. See applicants' specification at paragraph [0011], which states that deposition may occur at a current density as low as 0.1 ASD or as high as 120 ASD.

Applicants respectfully submit that claim 30 is patentable over the cited references because both Tsuji et al. and Dietterle et al.'s processes are directed to deposition of solders which are high in tin. Neither discloses a method to deposit a bronze which is high in copper, nor do they provide any reason to alter the copper ion to tin ion ratio to deposit such a bronze. This is explained in applicants' prior Amendment B. However, in order to expedite prosecution, applicants have entered the accompanying amendment requiring a copper-tin anode to further distinguish the claims from the cited references. Claim 30 is therefore additionally patentable over the cited references since neither reference discloses the use of a copper-tin anode, nor do they provide any reason to use such an anode. According to MPEP §2143.03,

> **2143.03 All Claim Limitations Must Be Considered**
> "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

Neither Dietterle et al. nor Tsuji et al. disclose the use of copper-tin anodes in their methods. Rather, in both references, they employ tin anodes. See Dietterle et al. at paragraphs [0020], [0060], and [0075] and their claim 9. See also, Tsuji et al. at Abstract; Col. 1, lines 31-45, Col. 25, lines 9-14, Col. 25, lines 62-67, Col. 31, lines 6-11, among others.

Moreover, neither Tsuji et al. nor Dietterle et al. provide any reason for substituting their tin anodes with applicants' copper-tin anode, and such reasoning is a critical component of establishing *prima facie* obviousness, as stated in MPEP §2142:

> **ESTABLISHING A *PRIMA FACIE* CASE OF OBVIOUSNESS** **The key to supporting any rejection under 35 U.S.C. 103 is the clear articulation of the reason(s) why the claimed invention would have been obvious**. The Supreme Court in *KSR International Co. v. Teleflex Inc.*, 550 U.S. ___, ___, 82 USPQ2d 1385, 1396 (2007) noted that the analysis supporting a rejection under 35 U.S.C. 103 should be made explicit. The Federal Circuit has stated that **"rejections on obviousness cannot be sustained with mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness**." *In re Kahn*, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006). See also *KSR*, 550 U.S. at ___, 82 USPQ2d at 1396 (quoting Federal Circuit statement with approval).

Since the cited references neither disclose the use of a copper-tin anode nor provide any reason to use such an anode, the combination of references does not provide a basis for establishing a *prima facie* case of obviousness. Accordingly, applicants submit that claim 30 is patentable over the cited references and respectfully request that the Office withdraw the rejection.

In further support of the patentability of claim 30, applicants submit that the methods disclosed in the cited references do not deposit bronzes having at least about 60 wt% Cu since copper ions in solution would become rapidly depleted without the use of the copper-tin anode. Since Tsuji et al. and Dietterle et al. employ tin anodes,

electrolytic deposition according to their method initially depletes both copper ions and tin ions from solution. Even if, for the sake of argument, the copper concentration were initially very high compared to the concentration of tin ions (which is not disclosed in any embodiment in either reference), as deposition progresses, the electrolytic solution becomes comparatively depleted in copper ions (since copper ions are not replenished) and comparatively enriched in tin ions (from oxidation of the tin anode). This results in deposition of a coating comprising an ever increasing tin content and an ever decreasing copper content, such that the predominant component of the coating is tin. So Dietterle's and Tsuji's conditions flowing from their anode selection do not deposit a bronze of at least 60% Cu.

Claims 31-34, 36-38, and 56-60 depend from claim 30 and are patentable for the same reasons as claim 30 and by virtue of the additional requirements therein.

2. Claim 63

Claim 63 depends from claim 30 and is patentable for the same reasons as claim 30 and by virtue of the additional requirements therein.

3. Claims 64-67

Reconsideration is requested of the rejection of claims 64-67 as being obvious over Dietterle et al. (WO02/24979 and U.S. 7,179,362) in view of Tsuji et al. (U.S. 6,607,653) and further in view of EP 1,091,023.

Claims 64-67 depend from claim 30 and therefore require deposition of a high copper bronze by applying a

current through a copper-tin anode. As explained above, neither Dietterle et al. nor Tsuji et al. disclose the use of copper-tin anodes. The EP 1,091,023 reference does not correct these deficiencies, since this reference also does not disclose the use of copper-tin anodes.

B. Electrolyte Claims

All electrolyte claims have been canceled herein.

CONCLUSION

In view of the foregoing, applicants respectfully request reconsideration and allowance of the pending claims.

Respectfully submitted,

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